



Assessment of a Greenland lee cyclone

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On 3 March 2007 between 0920 and 1545 UTC the mesoscale structure of a mature lee cyclone SE of Greenland was successfully captured during a flight with the Facility for Airborne Atmospheric Measurement's (FAAM's) BAE 146 aircraft. The cyclone formed under westerly flow over Greenland, two days prior to the flight. The development of the cyclone was highly influenced by an upper level southward moving PV anomaly, associated with an outbreak of cold air over Greenland. This upper level forcing manifested itself as a deep tropopause fold with mixing of stratospheric air into the troposphere. Air of stratospheric origin revealed itself as a slot of extremely dry air with high potential temperature and high ozone concentrations, clearly visible in data from both dropsondes and in situ measurements. The tropopause fold was confirmed by the temperature profiles of the dropsondes released closest to Greenland, showing the tropopause at approximately 450 hPa. The mesoscale structure of the cyclone was in general consistent with Shapiro and Keyser's (1990) warm-core occlusion stage. Like Shapiro and Keyser's model, this cyclone had warm air in its centre, encircled by a relatively shallow front. Low level jets were observed on the cold side of the front, with wind speeds exceeding 34 m/s. These wind speeds were considerably higher than predicted by the NWP model. In situ measurements showing a combination of relatively warm and dry air in the centre of the cyclone indicated possible stratospheric origin of this air in contrast to the suggestion by Shapiro and Keyser of a low-level origin. The extent of the stratospheric intrusion indicates that successful modelling of cyclones in this area demands adequate handling of upper level forcing as well as high resolution of the Greenland orography.